Harding Lawson Associates

January 14, 1999

Mr. Wayne Praskins
U.S. EPA – Region IX
75 Hawthorne Street
San Francisco, CA 94105–3901

Response to Comments:
Draft Phase 2 Treatability Study Work Plan,
Pilot Scale Groundwater Treatment System,
Baldwin Park Operable Unit, San Gabriel Basin, California

Dear Mr. Praskins:

On behalf of the Baldwin Park Operable Unit (BPOU) Steering Committee this letter contains responses to your comments on both draft versions of the Phase 2 Treatability Study Work Plan. Harding Lawson Associates (HLA) first issued the Phase 2 Treatability Study Work Plan on May 20, 1998. We received comments from U.S. EPA dated July 28, 1998 and took these comments into consideration when preparing the most recent version of this work plan dated October 29, 1998. However, we did not respond to each U.S. EPA comment in writing, and with respect to several comments, including those on the project schedule, the project scope was not sufficiently developed to fully address U.S. EPA comments.

The second version of the work plan (October 29, 1998) contained substantial changes from the first version due to the detection of new chemicals in groundwater production wells owned by La Puente Valley County Water District (LPVCWD) and discussions between the BPOU Steering Committee, U.S. EPA, California Department of Health Services, LPVCWD, and the Main San Gabriel Basin Watermaster regarding the scope of the project. As a result significant changes were made to the proposed project approach and treatment train.

Attachments to this letter specifically address U.S. EPA's comments dated July 28, 1998 and December 11, 1998. Because we were not able to fully address U.S. EPA comments in the October 29, 1998 Phase 2 Treatability Study Work Plan, and because the project is considerably better developed than it was in late 1998, we will revise and reissue the work plan by February 5, 1999.

The project is being implemented using a design-build approach. Therefore portions of the project will be under design while other components will be under construction. This approach will save substantial time and money but necessitates agreement and close cooperation regarding project review. In addition, the project is being implemented in conjunction with a larger project at the LPVCWD site. The larger project involves the design and construction of another water treatment plant using ion exchange technology for perchlorate and nitrate removal. Stetson Engineers, the Main San Gabriel Basin Watermaster's engineering consultant, is responsible for design and construction of both treatment plants. HLA will be performing the

Phase 2 Treatability Study supporting Stetson's overall site management. We recommend that U.S. EPA, Stetson Engineers and HLA meet soon to discuss and agree upon procedures for U.S. EPA review of the design, construction, and operation of the Phase 2 Treatability Study.

If you wish to discuss any subject related to the Phase 2 Treatability Study please call John Catts at (415) 899-8825 or Jim Michael at (303) 293-6128.

Yours very truly,

HARDING LAWSON ASSOCIATES

John G. Catts, Ph.D.
Vice President

cc: Don Vanderkar – BPOUSC
BPOU Steering Committee
Jim Michael – HLA
Ron Borrego – HLA
Mike Berlien – LPVCWD
Rick Hanson – TVMWD
David Towell – CH2M-Hill
Carol Williams – MSGBWM
Richard Sase – MSGBWM
Steve Johnson – Stetson Engineers
Jeanne-Marie Bruno – MWD
Gary Yamamoto – DHS
Rick Sakaji – DHS
Nabil Saba – DHS (3 Copies)
Kirby Brill – WQA

jgc254

Response to EPA Comments on May 20, 1998 Phase 2 Treatability Study Work Plan		
Location	**EPA Comment**	**Response**
p. 1, col. 2, ¶ 3	The text states that: "Finally, the results of the treatability study indicate that the effluent water quality (following disinfection and filtration) should meet all applicable standards..." This sentence should be revised, since the Phase 1 study did not include testing of filtration or disinfection processes, and did not appear to include analysis for all Title 22 water quality parameters.	The text has been revised to state that additional work is needed to evaluate disinfection and filtration and demonstrate that the treatment processes will reliably produce potable water. This is a specific objective of the Phase 2 Treatability Study. The effluent from the Phase 1 bioreactor was tested for Primary and Secondary State and Federal potable water quality standards on 5/18 and 6/15/98.
p. 3, col. 2, ¶ 3, last sentence	The text states that: "...the microorganisms multiply to a steady-state level, determined by the organic loading to the system." What does the phrase "steady-state" mean here? Doesn't the need for a biological growth control system indicate that microbial growth exceeds death? Don't the rates of microbial growth and reproduction also depend on factors other than organic loading to the system?	The term "steady-state" as used means the number of microorganisms exiting the system, either through death or detachment, equals the growth rate of new microorganisms. As the microorganisms die or detach they float to the top of the system. Carbon is entrained with this biomass. The biological growth control system removes biomass from the entrained carbon and returns the carbon to the reactor. Rates of microbial growth depend on a variety of factors in addition to organic loading. These include dissolved oxygen content and nutrient levels. In this reaction scheme, the prime factor controlling (limiting) microbial growth in the availability of organic substrate. Under normal operating conditions, oxygen and nutrient levels are sufficient to provide for additional microbial growth.

p. 3, col. 2, ¶ 4	The text states that: "Nonviable microorganisms eventually become detached from the medium and exit the system..." Is there evidence that microbes are exiting the system? If so, is there evidence that the exiting microbes are dead or dying? The text states that "...The reaction takes place under anoxic conditions...," but Appendix F in the Phase 1 report indicates that low levels of DO remain in the bioreactor. Please comment.	Biomass can be directly observed exiting the bioreactor, necessitating the need for the biological growth control system. The detached biomass was not tested to determine whether or not the biomass is still viable; however, the detached biomass visually appears to be the same as the attached biomass. The term anoxic as used in this context means that very low amounts of oxygen are present. The term anaerobic would have been used if dissolved oxygen were absent and conditions considered reducing.
p. 3, § 3	Please explain further the rationale for selection of ethanol as an organic substrate, and discuss other possible substrates	Ethanol was selected as the organic substrate primarily for several reasons. Previous work comparing ethanol and methanol performance showed better utilization of ethanol. Evaluation of other substrates in published literature for purposes of denitrification shows some substrates that did not perform well (e.g. corn syrup) while other substrates were shown to perform (e.g. acetate) but are more expensive than ethanol. Relatively pure ethanol is available in adequate quantities at an economical price. The specially denatured alcohol selected for the Phase 2 study contains ethanol with approximately 1 percent ethyl acetate.
p. 4, § 4	Phase 2 objectives should be clarified or supplemented to include the following: i) demonstration that perchlorate and alcohol concentrations can be consistently reduced to below laboratory reporting limits (i.e., for	The objectives for the Phase 2 Treatability Study are: 1) Confirm Destruction/Removal Efficiencies; 2) Establish Operating Parameters; 3) Collect Data to Support Permitting as a

		much longer than the several day period demonstrated in Phase 1);	Potable Water Source; and 4) Collect Data to Support Design of Full-Scale System.
	ii)	evaluation of the potential for the production of byproducts of alcohol degradation and cell metabolism and growth. Please comment on the value of isolating and/or identifying the microorganisms present in the bioreactor in order to evaluate the potential for the microorganism to release toxic substances into the water. Is there a potential for the trace metals present in bacterial enzymes to be released at toxic levels? Is there a potential for changing redox conditions to result in the formation of organic-metal complexes? Is it known whether the microoganisms make use of molybdenum, as do nitrate-reducing bacteria (and the perchlorate-reducing baterium identified by the Air Force Research Lab), or another potentially more toxic metal?;	PART 1: In addressing Objective 1, we will demonstrate that perchlorate and alcohol concentrations can be consistently reduced below laboratory reporting limits (i.). (ii.) will be addressed through Objectives 2 and 3. We feel that testing the microorganism population for the presence of human pathogens is an effective way to determine if the microorganisms pose a threat to human health. We believe the potential for trace metals to be released at toxic levels is very low. We do not feel it is likely that organo-metal complexes will be formed at measurable levels. Phase 1 testing did not show increases in metal concentrations across the bioreactor.
	iii)	verification of the Phase 1 finding that vinyl chloride and other unwanted byproducts are not produced in the bioreactor;	The Phase 2 effluent will be exhaustively tested and we are confident that any detrimental effluent characteristics will be detected. We look forward to working with EPA to develop a comprehensive SAP.
	iv)	evaluation of the potential for the treated effluent to cause microbial growth in a drinking water distribution system;	Objective 3 will address comments (iii.), (iv.), and (v).
	v)	testing the treated effluent for taste and odor and other secondary drinking water parameters;	Objective 2 will address comment (vi.). Objectives 2, 3, and 4 will address comment (vii.). The characterization will include the nature of the response, recovery time, and
	vi)	determination of optimal phosphorus dosage;	

	vii) testing to fully characterize the treatment process' response to plausible operational problems and perturbations (e.g. power outages, interruption of chemical feed, changes in influent composition). The characterization should include the nature of the response (e.g. changes in perchlorate removal effectiveness and other physical and chemical indicators of system performance), recovery time, and evaluation of the need for backup systems. The workplan should include a discussion of the value of adding each of the following objectives, and add objectives deemed worthwhile: i) identification of the active microorganisms in the innoculum and in the bioreactor periodically after startup; ii) identification of microbial nutrient requirements in addition to C, N, and P (e.g. trace metals); iii) evaluation of bioreactor performance using an alternate organic substrate; iv) laboratory analysis of biomass and/or bioreactor effluent for pathogens or other indicators of the presence of pathogens; v) improved understanding of the bioreactor's hydraulic characteristics, in order to better predict the bioreactor's response to changes in influent conditions.	evaluation of backup systems. PART 2: We believe the objectives outline in the revised Draft Phase 2 Treatability Study Work Plan encompass most of the suggested items except for (i.) and (iii.). Our response to (i.) is discussed above; (iii) will be evaluated if time and budget permit.

p. 5, § 4.2, ¶ 1	Please comment on the capability of ion selective electrodes to measure perchlorate and nitrate in water (e.g. Are they capable of reliably measuring perchlorate concentrations in water, but only at high concentrations?). In any case, if improvements in ion selective electrodes are possible in the near future, their use should be reevaluated during the design of the BPOU treatment facilities.	Ion specific electrodes are best suited for applications where there are high concentrations (> 500 µg/L) with low interference (e.g. low TDS). For the low concentrations of perchlorate present in the BPOU, ion specific electrodes will not serve as an appropriate monitoring device. The current perchlorate detection limit is approximately 400 µg/L. If ion selective electrode technology improves its use will be considered. While the concentrations of nitrate may be high enough to detect concentrations, the interferences of the groundwater matrix have not been characterized making any readings uncertain. Ion specific electrodes will be reevaluated if improvements are made that make them appropriate for this application.
p. 5, § 4.2, ¶ 2	Phase 1 study results show relationships between DO, ORP, and bioreactor performance, but did not demonstrate that "bioreactor performance could be predicted..." It seems premature to claim that all variables significantly affecting bioreactor performance have been identified. What additional work is planned to demonstrate that DO and ORP are good surrogates for perchlorate and nitrate reduction? Which other parameters are being considered for monitoring reactor performance? Has consideration been given to periodically measuring the ratio of perchlorate consumption/cell mass, and determining its	Agreed. The Phase 1 study identified what are likely to be the major variables associated with bioreactor perform. The Phase 2 study is designed to confirm these findings and refine our understanding of bioreactor behavior. The Phase 2 study will monitor a wide variety of system operating parameters and chemical analyses. These results will be examined during and after the study to see if other statistically based relationships exist between bioreactor performance and operating parameters. The Sampling and Analysis Plan will provide a detailed sampling scheme for various phases of system operation. The SAP will consider the use of measuring or

	relationship to bioreactor performance?	calculating perchlorate consumption versus cell mass and determining the relationship to bioreactor performance.
p. 5, § 4.3, ¶ 1	The text states that "...there is a potential that treated water may contain bacteria..." The bioreactor effluent in Phase 1 consistently had high levels of bacteria. Please comment.	The bioreactor effluent will contain bacteria. At issue is whether these bacteria will be present in the treatment plan effluent, whether they constitute human pathogens, and whether concentrations are low enough to meet drinking water standards. The bioreactor effluent will be analyzed per DHS guidelines to determine its suitability as drinking water source. The Phase 2 treatment train has changed significantly from the initial draft work plan. Immediately downstream from the bioreactor, multi-media filters will remove most of the bacteria from the effluent. The next treatment step is UV/Oxidation system where any remaining bacteria should be killed. The UV/Oxidation system is followed by carbon adsorption and then by a chlorine disinfection system. This multiple-barrier treatment train should prevent any bacteria from exiting the treatment system.
p. 5, § 4.3, ¶ 2	We suggest that the "characterization of Disinfection Byproducts include a discussion of disinfection options, disinfection locations(s), disinfection byproduct (DBP) formation potential, and the relationship between organic substrate and production of DBPs. (Alcohols may produce methyl-bearing aldehydes or ketones that are known to react with chlorine to produce chloroform, a trihalomethane [THM]. Chloroform was measured on 1/28/98 in the bioreactor effluent at 63 ug/L, along with acetone at 6,700 ug/L). If appropriate, the laboratory reporting limits	The characterization of Disinfection By-Products (DBP) will include a discussion of the optimal disinfection options, disinfection location, and DBP formation potential. The revised treatment system and use of a higher grade of ethanol were selected to minimize in the effluent alcohol or other organics that may produce excessive DBPs will be present at the time of disinfection. We plan on working with the laboratory to explore obtaining a lower detection limit on ethanol.

	for alcohol should be reduced.	
p. 6, 1st line [also p. 10, § 10, ¶ 2]	The text states that "the microorganism innoculum will be characterized." Please describe further. Please describe the origin of the microorganisms in greater detail. If the originate at a baby food processing plant, where in the processing operation are they collected? Please describe the type of environment to which the microbes would have exposed and acclimated.	The microorganism innoculum originates from a wastewater sump in a baby food processing plant. The microorganisms' environment is aerobic. This source of microorganisms was selected because of the stringent monitoring for human pathogens in the baby food processing industry. The characterization of the innoculum is to further screen for human pathogens and includes bacteriology (total and fecal coliform and heterotrophic plate count), giordia and cryptosporidium, and viruses. Specific analyses to be performed will be developed during the design process and included in the SAP.
p. 6, § 4.4, col. 1	Given that the La Puente VCWD's wells have been shut down for some time, perchlorate concentrations may change after startup as steady state conditions are approached. Should samples be collected at increased frequency during startup to evaluate the bioreactor's performance over a range of influent conditions?	The system influent will be sampled on a daily basis until the influent has stabilized. Samples will then be gathered on a less frequent basis (e.g. weekly). The SAP will detail the sampling approach to be used during startup.
p. 6, § 5.0	Has the Steering Committee considered operating the 30 gpm pilot scale treatment unit to address some of the Phase 2 objectives, rather than attempting to address all of the Phase 2 objectives at a much higher flow rate?	Yes. Proceeding with the 500 gpm system was felt to be necessary to meet the overall project objectives and schedule.
p. 7, col. 1, ¶ 5	Will the presence and use of ethanol require special equipment beyond the "hazardous duty diaphragm metering pump" mentioned in the text?	The presence of ethanol will require specific permitting, delivery, and storage provisions. The pump mentioned in the text is the only piece of equipment necessary for the handling of alcohol.
p. 7, col. 2	How will samples collected from sampling ports 7 and 8 differ?	This comment no longer applies. Proposed sampling ports will be detailed in the SAP.

p. 7, col. 2, middle ¶	Please explain further the statement that biomass discharged from the bioreactor will not affect the operation of the air stripper.	This comment is no longer applicable. There is no longer an air stripper in the treatment train.
p. 8, col. 1, ¶ 3	DHS provides the following comments, which may affect the treatment equipment tested during Phase 2: (i) The bioreactor effluent must be approved by DHS as a water source; (ii) Post-bioreactor treatment must meet or exceed that required by the Surface Water Treatment Rule (which included specified removal rates for viruses and other pathogens); (iii) A tracer study may be required to demonstrate compliance with Title 22, Section 64653 if the loading rate specified in Title 22, Section 64660 (b) is exceeded; (iv) The treatment train must meet turbidity standards established in Section 64653 (c); (v) That issuance of a domestic water supply permit for use of the biological treatment process will, if warranted, occur after a review process subsequent to and separate from the Phase 2 study; Please include dates in the schedule for obtain DHS approval for use of the bioreactor effluent as a water source; or submission, review, and approval of a filtration system study protocol (to the DHS internal Surface Water Treatment Committee); and for satisfying any other DHS requirements.	Responses to this comment have been included in our response to DHS's comments. (i) Analysis of the bioreactor effluent including total coliform, pathogen analysis, and other analysis to secure approval as an approved water source will be submitted to DHS. This will be further detailed in the SAP. (ii) The multi-barrier treatment train is designed to provide a 99.9 percent reduction in Giardia cysts and viruses through filtration and disinfection. (iii) A tracer study will be completed during Phase 2 if required to demonstrate compliance with Title 22, Section 64653. (iv) Turbidity in the bioreactor effluent will be monitored. Although individual measurements of the turbidity of bioreactor effluent were in the range of 30 NTU, these measurement were made while the system was under modification. The effluent turbidity was documented to less than 10 NTU under normal operating conditions and we expect turbidity in the range of 2-5 NTU for the Phase 2 system. (v) The issuance of domestic water supply permit is one of the objectives of the Phase 2 study. We understand that

	Also, DHS indicates that coagulation and flocculation may be needed. Please discuss.	this will encompass a stringent review process that may occur after the field work is completed. A schedule for the Phase 2 Treatability Study has been provided under separate cover. The BPOU Steering Committee has participated in several meetings with DHS on this treatability study and will continue to participate in such meetings until an operating permit is obtained. Conceptual design information on the multimedia filtration system is presented in Section 5 and 6 of the Phase 2 Treatability Study Work Plan. The multimedia filters will be operated in a biologically active mode. A polymer will be added to the bioreactor effluent to promote removal of suspended solids in the multimedia filters. The proposed treatment train does not include coagulation, flocculation, or sedimentation processes. We believe that effluent from the bioreactor will have a sufficiently low loading of suspended solids that coagulation, flocculation, and sedimentation will be unnecessary. If initial testing results do not support this assumption, consideration will be given to adding this unit process. Please refer to Figure 5.1 for a graphical presentation of the proposed treatment system.
p. 8, col. 1	The treatment equipment description does not include provision or establishing a chlorine residual. Please comment. Where in the treatment process will waste sludge or solids be produced? Please describe	The revised Phase 2 Treatability Study Work Plan disinfection system is designed to provide a disinfectant residual of at least 0.2 mg/L in the effluent at all times. Please refer to Figure 5.1 of the revised Phase

	the nature of the wastes, volumes produced, and methods of handling and/or disposal.	2 Treatability Study Work Plan. Waste sludge will be generated from the filter press located immediately after the clarifier. This sludge is generated from floculation/sedimentation of waste biomass from the bioreactor and spent backwash water from the multi-media filters. The sludge will be coagulated biomass; we anticipate approximately 110 pounds of sludge will be produce daily. Sludge production will be measured during system startup Disposal options will be evaluated once the sludge has been characterized.
p. 8, Section 8.0	The text discusses "key permitting requirements." What other permits are needed beyond those listed?	The following permits are needed: 1. Construction permits. 2. NPDES Discharge Permit. This permit will be obtained by the Watermaster from the Regional Water Quality Control Board – Los Angeles Region (RWQCB). 3. ATF Permit. The Bureau of Alcohol, Tobacco, and Firearms (ATF) needs to issue an Industrial Alcohol User Permit. 4. DHS Operating Permit. The operating permit must be obtained from DHS in order for the Phase 2 Pilot system to introduce water into the potable water supply. Securing this permit is the ultimate goal of the Phase 2 activities. 5. Air permit. We are evaluating whether an air permit is needed for the onsite storage tanks required to store ethanol. 6. Fire Department permit. A business plan must be filed with Fire Department (local) detailing the materials and quantities stored onsite. 7. Certification of additives through DHS. The chemical additives in the study must

		be on the National Sanitation Foundation (NSF) or UL drinking water additives certified list.
p. 8, Section 8.2	Please include a timetable for applying or and obtaining a Regional Board discharge permit.	This activity is being conducted by the Watermaster. The Watermaster's consultant, Stetson Engineers, reports that they believe the application and approval process will be complete in conformance with the product schedule previously distributed.
p. 9, Section 8.3	Please include a timetable for obtaining an ATF permit.	The submittals for the ATF permit have already been made. Ms. Tomika Moore with ATF reported that all materials have been received and she should have a response before the end of January, 1999.
p. 9, Section 9.1, col. 2	Please describe the procedure for adding the microbial seed.	The microbial seed is added directly into the top of the reactor. The reactor is run with 100 percent recirculation mode for two days. The recirculation rate is then incrementally increased and allowed to achieve stable perchlorate reduction until the design flow rate is met.
p. 10, Section 10.0	The SAP/QAPP should be submitted for review by EPA, DHS, and other relevant agencies. Sample collection and analysis should reflect additional objectives added in response to the comment on page 4, Section 4.0. The SAP/QAPP should briefly describe non-EPA methods and provide complete references. If a reference is <u>not</u> to a commonly-available journal or textbook, a description of the method should be included as an appendix to the SAP.	Agreed. The SAP and QAPP will be prepared during treatment system design and provided to EPA and DHS for review and comment prior to system startup. The SAP/QAPP will briefly describe any non-EPA methods and provide complete references. We plan on working with the laboratory to explore obtaining a lower detection limit on ethanol at a minimum.

p. 11, Section 10.3	Please supplement the list of analytes to account for the expanded list of objectives. Total Organic Carbon (TOC) should be included. Also note that new or revised MCLs and MCLGs have been proposed for chlorite, trihalomethanes, chloroform, haloacetic acids, and several other chemicals as part of the Disinfectants/Disinfection Byproducts Rule.	A complete list of analytes will be presented in the Sampling and Analysis Plan (SAP). The Draft Phase 2 Treatability Study Work Plan dated October 29, 1998 includes a preliminary summary of analytes and methods (See Table 8.1). This list has been revised to include TOC. Consideration of the Disinfection Byproducts Rule will be made during preparation of the SAP. The SAP will detail the precision of the proposed analytical methods with respect to MCLs and MCLGs for each analyte as applicable.
p. 11, Section 10.4	Given the apparent variability in measured perchlorate concentrations during Phase 1 testing, a sufficient number of replicate samples should be analyzed to better estimate the precision of the analytical method.	Agreed. This will be detailed in the Sampling and Analysis Plan.
p. 12, Section 11.1	Does the project team include individuals with expertise in microbiology, bacteriology, and related disciplines?	Yes. The project team includes individuals with expertise in microbiology and significant experience with biological systems.
p. 12, Section 11.2, last ¶	Please include provisions for frequent interim reporting to EPA after startup (weekly to biweekly). Reporting can be by mail, fax, telephone, or email. Please include provisions for less frequent interim written reporting. There is no communications plan in Section 10 as stated in the text.	A communications plan will be included in the Sampling and Analysis Plan. The communications plan will include provisions for biweekly reporting by telephone, monthly reporting via fax and regular mail, and quarterly interim written reporting.

Response to EPA Comments on October 29,1998 Phase 2 Treatability Study Work Plan		
Location	**EPA Comment**	**Response**
p4-1, § 4.1	*The Phase 1 Report (§5.4.6)* provides estimates of the recovery time following "planned" and "unplanned" bioreactor shutdowns. The Phase 2 objectives should be expanded to include additional characterization of the treatment process' response to plausible operational problems and perturbations to verify the Phase 1 findings. Also, please provide additional information on design features, backup systems, and operational strategies that will be used to minimize the likelihood of unplanned shutdowns and minimize the recovery time following a shutdown.	Objective 4.2 Established Operating Parameters will be expanded to include additional characterization of the treatment process' response to plausible operation problems and perturbations to verify the Phase 1 findings. Additional information on design features, backup systems, and operational strategies that will be used to minimize the likelihood of unplanned shutdowns and minimize recovery time will be detailed in the Operation and Maintenance.
p4-1, § 4.1	*The Phase 1 Report* describes the apparent production of vinyl chloride after the bioreactor was shut down. Please describe steps to be taken to minimize the likelihood that conditions promoting vinyl chloride formation will occur, and address the planned treatment train's capability to remove any vinyl chloride produced.	Vinyl chloride was detected in the Phase 1 bioreactor effluent after an extended unplanned shutdown where the bioreactor was probably supporting anaerobic biochemical activity. Once the bioreactor was restarted and returned to anoxic conditions, vinyl chloride production ceased. To minimize the likelihood of vinyl chloride production, we will work to ensure that any bioreactor shutdowns are brief and do not allow the system to turn anaerobic. Power outages will be handled through emergency power generation recycling water through the bioreactors. Regardless, the UV/Oxidation system will remove vinyl chloride and provides a second barrier against vinyl chloride being released. In addition, the GAC adsorbers provide a third "emergency" barrier (with a few days of adsorption before breakthrough) against vinyl chloride. We are confident this multi-barrier

		system will prevent any vinyl chloride from exiting the treatment train.
p4-2, § 4.2	This section provides a list of "key operating parameters" for each of the five "unit operations." Please clarify the intended use of this list. Some of the listed items appear to describe inputs to the treatment process that are easily manipulated during operation while other items are indicator of system response (e.g., DO profile, pressure drop). Which parameters will be varied during testing?	Agreed. Some of these parameters will serve as indicators of system performance while others can be varied to directly affect system performance. The work plan will be revised to reflect these distinctions. The operations and maintenance (O&M) plan will describe in detail the plan for varying each performance parameter and monitoring each indicator parameter during operation.
p4-4, §4.3	Section 3 includes a brief mention of aldehydes, ketones, and carboxylic acids as intermediates and potential byproducts of the metabolic breakdown of ethanol. To guide sampling and analysis activities during the Phase 2 study, please discuss in greater detail the chemistry and biochemistry relevant to the degradation of alcohol and cell metabolism and growth. As part of the discussion, please comment on the potential for microorganisms present in the bioreactor to release toxic substances into the water. Is there a potential for trace metals present in bacterial enzymes to be released at toxic levels? Is there a potential for changing redox conditions to result in the formation of organic-metal complexes? Is it known whether the microorganisms make use of molybdenum, as do nitrate-reducing bacteria (and the perchlorate-reducing bacterium identified by the Air Force Research Lab), or other potentially more toxic metals?	We feel that testing the microorganism population for the presence of human pathogens is an effective way to determine if the microorganisms pose a threat to human health. We believe the potential for trace metals to be released at toxic levels is low. We do not feel it is likely that organo-metal complexes will be formed at measurable levels. Although increases in metal concentrations across the bioreactor were not observed during Phase 1 testing, characterization for organo-metallic complexes was not performed. The Phase 2 sampling plan will include exhaustive testing for all drinking water parameters required by California regulations and we are confident that any detrimental characteristics will be detected.

p4-4, § 4.3	Section 4.3 mentions that data will be collected to evaluate the formation of disinfection byproducts (DBPs). To guide sampling and analysis activities, please discuss the chemistry of DBP formation in greater detail. Also, in the event that the planned organic substrate (denatured alcohol) and disinfectant (sodium hypochlorite) produce unacceptable levels of DBPs, what alternative organic substrates or disinfectants are likely to produce lower levels? Will there be any impact on the design or operation of the treatment system from any of the new or revised MCLs and MCLGs proposed as part of the Disinfectants/ Disinfection Byproducts Rule (e.g., for chlorite, trihalomethanes, chloroform, halozcetic acids).	The text will be revised to add detail on DBP formation. The revised treatment train is designed to minimize the potential for DBP formation. Suspended material including biomass will be removed by the multimedia filter. In addition, operation of this filter in a biologically active mode will reduce concentrations of DBP precursors. UV/oxidation and LPGAC will further reduce concentrations of DBP precursors. The SAP and system monitoring will however address potential for formation of all DBPs including those with recent MCLs and MCLGs.
p4-4, §4.3	The text states that "the biological inoculum will be characterized using plate counts to identify the microorganisms present..." For the benefit of a non-microbiologist, please describe in greater detail the method of characterization, and what can be learned form identifying the microorganisms (e.g., Would identifying the microbes allow for the identification of microbial nutrient and trace metal requirements?). Will the microorganisms in the bioreactor also be characterized periodically after startup? Also, please describe the origin of the microorganisms in greater detail. If they originate at a baby food plant, where in the processing operation are they collected? Please describe the type of environment to which the microbes would have been exposed and acclimated and any data available indicating the potential for pathogens in the inoculum.	The microorganism inoculum originates from a wastewater sump in a baby food processing plant. The microorganisms' environment is aerobic. This source of microorganisms was selected because of the stringent monitoring for human pathogens in the baby food processing industry. As an alternative, biomass from the existing bioreactors at the Rancho Cordova Facility in Sacramento will also be evaluated as an inoculum. The characterization of the inoculum is to further screen for human pathogens and includes bacteriology (total and fecal coliform and heterotrophic plate count), giardia and cryptosporidium, and viruses. The text of the work plan will be revised to add more detail in this area. In addition the SAP will provide detail on methods to be used to characterize the inoculum and bioreactor effluent.

§ 4	The September 29, 1998 response to comments letter from HLA to DHS states that tracer studies are planned to evaluate the hydraulic characteristics of the reactor module (p.2 of 9/29/98 letter, response to comment #2). Please describe the planned studies.	The tracer study protocol has not yet been developed. We look forward to working with EPA and DHS to develop a protocol that effectively evaluates the hydraulic characteristics of the bioreactor. Out intent is to include the protocol in the SAP.
Figure 5.1	The report appears to specify gravity-fed GAC absorbers. Has the use of pressure-type GAC vessels been considered? Our consultants (CH2M Hill) point out that pressure units offer several cost and operational advantages over gravity-fed units: i) they allow the GAC to be more quickly and easily loaded and unloaded; ii) they would not allow VOCs to escape to the atmosphere; and iii) they allow longer run times before backwashing, minimizing "restratification" and early breakthrough of the GAC bed.	Agreed. GAC pressure vessels have been selected for the pilot plant instead of gravity fed adsorbers. The work plan will be revised to reflect this change.
Figure 5.1	The flow Diagram and description indicate that the Influent Flow Control Tank, GAC/FB Bioreactor, Media Separator, Media Filters, Equalization tank, and GAC Adsorbers are not covered and vent to atmosphere. We anticipate that vapors from these units and any other tanks whether quiescent or aerated) upstream of the final VOC removal process may need to be captured and routed to a VGAC adsorber as planned for the Post-Aeration Tank	All tanks and vessels upstream of the final VOC removal will be covered and the vapors will be routed to a VPGAC adsorber.
p5-3, §5.2.3 ¶ 1	The report describes the breakdown of most organic compounds to CO_2, H_20, and/or C1". Is the breakdown always complete, or are some partially oxidized byproducts likely to reach the GAC adsorber?	The UV/oxidation unit is designed to affect complete breakdown of most organic chemicals. It is unlikely that partially oxidized byproducts will reach the GAC adsorber. The UV/Oxidation system is designed for very high efficiency; however, the effluent of the unit and the GAC adsorber will be monitored to ensure that no partially oxidized organics are exiting the multi-barrier treatment train.

p5-3, §5.2.3 ¶2	The report states that nitrate interferes with the UV/Oxidation process and uses this rationale, in part, to specify placement UV/Oxidation process at the "end-of-the-train." Please explain the basis for the statement that nitrate interferes with UV/Oxidation. UV/Oxidation processes are often used as pretreatment of refractory organics (e.g., VOCs) prior to biological treatment.	Nitrate absorbs ultraviolet light at approximately the same wavelength that is the average output from UV lights incorporated into the UV/oxidation unit (200-300 nm) and converts it into heat. This leaves fewer photons available for absorption and photolysis by hydrogen peroxide to yield hydroxyl radicals. Higher nitrate concentrations result in longer required retention time and/or greater power consumption. Destruction of organic chemicals in the presence of nitrate is still possible, but power requirements are substantially higher than for low nitrate waters.
p6-1, §6.2	Is the Influent Flow Control Tank needed? Or could flow be maintained by instead using an inline flowmeter to directly regulate the variable frequency pumps?	The influent control tank has been removed from the treatment train. The original purpose of the tank was to prevent backflow in the bioreactor which can cause the distribution nozzles in the reactor to become plugged. The bioreactor vendor has now developed a method of backflow prevention that does not require an influent control tank. An inline flowmeter and variable frequency pumps will be used to control flow.
p6-2, §6.3, Last ¶	What steps have been taken to locate ethanol with lower concentrations of impurities (e.g., ketones, other alcohols) than in Phase 1?	HLA has worked extensively with a chemical supplier and has identified a high-purity ethanol containing ethyl acetate as the sole denaturant.
p6-2, §6.3 Last ¶	Page 3-4 indicates that the optimum ethanol dosage in Phase 1 was 40mg/1, yet the Phase 2 system will be sized to provide a maximum dosage of 30mg/1. We assume that the actual ethanol dose is expected to be substantially less than 30 mg/1 due to the lower nitrate concentrations at the La Puente well. Please clarify the basis for the assumed 30 mg/1 maximum.	Using the empirical equation developed on page 3-3 of the Phase 2 work plan, an ethanol dosage of 10-15 mg/l is calculated (using 5-7 mg/l nitrate-N and 1-3 mg/l oxygen). The Phase 1 treatability study identified an optimum dose approximately 40 percent higher than that predicted by the empirical equation. Using this as a guideline, the optimum ethanol dosage is expected to be 15-20 mg/l. A maximum dosage of 30 mg/l was used to allow for some contingency.

p6-3 ¶ 2	Is the maximum sludge yield (and the size of the sludge handling equipment) adequately estimated? The report bases the size of the sludge handling process on a sludge yield estimate of 28.8 lbs VSS/day. Using an alternative estimation method (EPA's Nitrogen Control Manual (EPA /625/R-93/010) Table 4-1), we calculate a sludge yield estimate of 68 lbs VSS/day – more than twice the estimate provided in the reports. The latter estimate assumes an ethanol dosages of 30 mg/l (about 63 me/1 COD), which results in an estimated sludge yield of 0.18 mg VSS/mg COD, and 1 1.3 mg/1 of VSS	HLA has used a sludge yield factor of 0.8 mg VSS/mg Nitrate-N reduced, based on published information for biological denitrification processes. According to the bioreactor vendor, this sludge yield factor is conservative and, based on their experience with similar systems, should be approximately 0.6 mg VSS/mg Nitrate-N reduced. Also, the EPA calculation uses the maximum ethanol dosage to determine sludge yield. The actual ethanol dose is expected to be about half of the maximum dosage. We acknowledge that actual sludge production may vary from our estimate but should be in the range of 25-35 lbs VSS/day. We will work with EPA during operation of the pilot plant to minimize biosludge production and the associated economics.
P6-4, ¶ 2	The report specifies a static mixer for mixing the polymer prior to the media filters. Ken Martins at CH2M Hill notes that this approach could work, but that a two tank system providing rapid/flash mix and flocculation would provide much more flexibility in manipulating the biomass floc ahead of filtration and obtaining good filtration performance (TSS and pathogen removal). The two tank system would require a small residence time tank (approximately 1 to 3 minutes) and high energy mixer (2 hp/ 1,000 gal) for rapid/flash mix, and a larger tank (providing 20 to 40 minutes residence time) and low energy mixing (30 to 70 fps/ft) to promote gently flocculation, Ken also recommends variable speed mixers in both tanks to provide flexibility during the operating phase of the test.	We feel the proposed system will provide adequate filtration performance; however, we will evaluate the use of the suggested modification during the ongoing design process. We will discuss our evaluation with EPA during the design.
Table 6-1, 3rd page	Based on the information provided on Page 3 of Table 6.1, each of the two planned multi-media filters appear to be designed for 250 gpm (4gpm/ft2 x 62.5 ft2). During each	We plan to test the filters at 4, 6, and 8 gpm/ft2 during the pilot test. The details for these tests will be discussed at length in the O&M plan. In general, the

	of the daily backwash cycles one of the filters will need to be off-line. With both filters needed to handle the 500 gpm design flow rate, how will the downtime be handled?	plant flow will be reduced as required during backwash of one filter (30 minutes maximum) to prevent an increase in flow to the other filter.
p6-6 §6.8	The report states that ferric chloride, ferric sulfate, and aluminum sulfate will be evaluated as coagulants. Ken Martins notes that he has found that ferric and alum sludges yield gelatinous weak floc and are difficult to dewater. He suggests evaluating a high molecular weight (1 million plus) cationic emulsion polymer, such as Cytech (American Cyanamid) Magnafloc 1563C.	We will evaluate a high molecular weight cationic emulsion polymer as suggested.
p6-6 §6.8	The report indicates that the dewatered sludge will attain about 40 percent solids by weight. Ken Martins notes that the percent solids is more likely to be 20 to 30 percent (particularly if ferric or alum is used), proportionally increasing the amount of sludge requiring disposal.	The sludge cake percent solids value has been reduced to 30%. This has increased the expected sludge cake production from 90 lbs/day to 120 lbs/day. Several filter press vendors have indicated that 30% is attainable.
p6-7 §6.8	Is the estimated clarifier sludge production of 4,392 gal/day correct? Based on the report's estimated clarifier solids production of 44 lbs dry solids/day, and a clarifier sludge solids content of 2%, the weight of wet sludge would be about 2,200 lbs/day. If divided by the density (about 8.5 lbs/gal), sludge production would be about 260 gal per day.	Table 6.1 contained a mathematical error. The correct calculation results in 215 gal/day of 2% sludge. Also, the estimated solids production has been reduced from 44 lbs dry solids/day to 36 lbs dry solids per/day (29 lbs biological + 7 lbs coagulant) due to an error in the assumed coagulant density. The revised work plan will contain the correct calculations.
p7-1 §7.0	The test mentions *some* of the key permitting requirements. What other permits are needed beyond those listed?	The following permits are needed: 1. Construction permits. 2. NPDES Discharge Permit. This permit will be obtained by the Watermaster from the Regional Water Quality Control Board – Los Angeles Region (RWQCB). 3. ATF Permit. The Bureau of Alcohol, Tobacco, and Firearms (ATF) needs to issue an Industrial Alcohol User Permit. 4. DHS Operating Permit. The operating permit

		must be obtained from DHS in order for the Phase 2 Pilot system to introduce water into the potable water supply. Securing this permit is the ultimate goal of the Phase 2 activities. 5. Air permit. We are evaluating whether an air permit is needed for the onsite storage tanks required to store ethanol. 6. Fire Department permit. A business plan must be filed with Fire Department (local) detailing the materials and quantities stored onsite. 7. Certification of additives through DHS. The chemical additives in the study must be on the National Sanitation Foundation (NSF) or UL drinking water additives certified list.
p7-1 §7.2 (schedule)	The text states that the process for obtaining or amending a Regional Board discharge permit "has been initiated." Please briefly describe the permitting process and provide a schedule with line items for each significant step in the process.	This activity is being conducted by the Watermaster's consultant, Stetson Engineers. The Watermaster reports that they believe the application and approval process will be complete within the current project schedule.
p7-1 §7.3 (schedule)	The text states that a permit application has been submitted to ATF. Please briefly describe the permitting process and provide a schedule with line items for each significant step in the process.	The submittals for the ATF permit have already been made. Ms. Tomika Moore with ATF reported that all materials have been received and she should have a response before the end of January, 1999.
p7-1 § 7.4 (schedule)	Please identify the chemicals requiring certification, and the "chemical sourcing and certification procedures" that have been initiated. Please briefly describe the certification process and provide a schedule with line items for each significant step in the process.	HLA has worked with a chemical supplier (Ms. Christine Stanley of Soco-Lynch) to identify the necessary additives already have the required certification.
(schedule)	Please provide a schedule with line items for submittal of a SAP/QAPP and O&M Manual. Please incorporate a two week period for DHS/EPA review.	The project schedule will be revised to include these items.
(schedule)	Please provide a schedule with line items for each submittal to DHS for use of the treatment plan effluent as	The project schedule will be revised to include this item.

	a drinking water source.	
(schedule)	Please submit a schedule with provisions for weekly to biweekly interim reporting to EPA after startup. Reporting can be by mail, fax, telephone or email. Please include provisions for less frequent interim written reporting.	A communications plan will be included in the Sampling and Analysis Plan. The communications plan will include provisions for biweekly reporting by telephone, monthly reporting via fax and regular mail, and quarterly interim written reporting.
(schedule)	Please submit a schedule with line items for submittal of design documents, EPA review of the design, and the procurement, construction, and start up periods. Please briefly describe the procurement strategy.	The project is to be designed and constructed, using a design-build approach. Therefore the project will not produce design packages for review at specific dates. Design of individual components of the system will be completed and those sections constructed or equipment ordered before the entire design is complete. Therefore if EPA wishes to review project design this must be done on a continuing basis. HLA will work with EPA to establish a review procedure.
Table 8-1	Please comment on the capability of ion selective electrodes to measure perchlorate and nitrate in water (e.g., Are they capable of reliably measuring perchlorate concentrations in water, but only at high concentrations?).	Ion specific electrodes are best suited for applications where there are high concentrations of anions (>500 µg/L) with low interference (e.g. low TDS). For the low concentrations of perchlorate present in the BPOU, ion specific electrodes will provide sound analytical performance at concentrations above 400 µg/L. While the concentrations of nitrate may be measurable, the interferences of the groundwater matrix have not been characterized making any readings uncertain. Ion specific electrodes will be reevaluated if improvements are made that make them appropriate for this application.
	Does the project team include individuals with expertise in microbiology, bacteriology, and related disciplines?	Yes. The project team includes individuals with expertise in microbiology and significant experience with biological systems.